



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/524,325 | 09/01/2005 | Rodney J Allam | 21280-0014US1 | 1156 |
| 26231 7590 03/16/2010 FISH & RICHARDSON P.C. P.O. BOX 1022 MINNEAPOLIS, MN 55440-1022 | | | | |
| EXAMINER | | | | |
| LEUNG, JENNIFER A | | | | |
| ART UNIT | | PAPER NUMBER | | |
| 1797 | | | | |
| NOTIFICATION DATE | | DELIVERY MODE | | |
| 03/16/2010 | | ELECTRONIC | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

Office Action Summary

Application No.

10/524,325

Applicant(s)

ALLAM ET AL.

Examiner

JENNIFER A. LEUNG

Art Unit

1797

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2009 and 23 November 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19, 21, 22, 24, 25 and 27-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19, 21, 22, 24, 25 and 27-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-940)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(c), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(c) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 23, 2009 has been entered.

Status of the Claims

2. Claims 1-18 are withdrawn from consideration. Claims 20, 23 and 26 are cancelled. Claims 19, 21, 22, 24, 25 and 27-29 are under consideration.

Claim Objections

3. Claim 19 is objected to because of the following informalities:

At line 24: "carbon-monoxide" should be changed to --carbon monoxide--.

At line 25: "Argon" should be changed to --argon--.

At line 26: "cryogen" should be changed to --cryogenic--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 19, 21, 22, 24, 25 and 27-29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 19, the added limitation of “a conduit for feeding separated carbon-monoxide product from said cryogenic distillation column to said syngas conversion system to remove Argon in a region above a bottom of the cryogen distillation column,” (at lines 24-26), does not appear to be supported by the specification or drawings.

The limitation suggests that the feeding of carbon monoxide product from the cryogenic distillation column to the syngas conversion system and the removing of argon in a region above a bottom of the distillation column are provided by the same conduit. However, as noted from Applicant's specification, the two functions are provided by two separate conduits:

The specification (see page 14, last paragraph, to page 15, first paragraph) states,

“The apparatus may further comprise a cryogenic distillation column, e.g. a carbon monoxide splitter column, for separating carbon monoxide from first said cryogenic liquid or from a cryogenic liquid derived therefrom to produce separated carbon monoxide product and substantially carbon monoxide-free cryogenic liquid. The apparatus may further comprise conduit means for feeding separated carbon monoxide product from the cryogenic distillation column to the syngas conversion system.

Additionally, the apparatus may further comprise conduit means for removing an argon-enriched stream from the region of high argon concentration (and consequently low carbon monoxide concentration) in the carbon monoxide splitter column. Preferably, the argon-enriched stream is removed from the location of maximum argon concentration.”

The specification (see page 27, second paragraph) also states,

“... In the carbon monoxide splitter column 296, methane and argon are separated from carbon monoxide to give carbon monoxide product 300 from the top of the column 296. A vapour side stream 302 is withdrawn from this column at a location of maximum argon concentration. This argon-enriched side stream 302 is mixed with the low pressure fuel stream 260.” (see also FIG. 3).

Thus, the function of “feeding separated carbon monoxide product from said cryogenic distillation column to said syngas conversion system” is provided by the conduit 300 at the top of the column 296. The function of removing argon in a region above a bottom of the column is provided by another conduit 302. The Examiner is unable to locate any discussion within the specification of a single conduit which performs both of the recited functions.

5. Claim 22 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear as to the relationship between the “conduit means for feeding separated-carbon monoxide product from said cryogenic distillation column to said syngas conversion system” and “a conduit for feeding separated carbon-monoxide product from said cryogenic distillation column to said syngas conversion system” set forth in claim 19 (at lines 24-26). The Examiner suggests canceling the claim, because the limitation appears to be redundant.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in

Art Unit: 1797

section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 19, 22, 24 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy '096 (US 4,782,096) in view of Fong et al. (US 5,496,859), Banquy '130 (US 4,888,130), Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461).

Regarding claims 19 and 22, Banquy '096 (FIGS. 1-3) discloses an apparatus comprising: a syngas generation system (i.e., comprising a "primary steam reforming" zone and a "secondary oxygen reforming" zone; in detail in FIG. 2) generating syngas **11** by reaction of methane **2** with steam **5** and oxygen **8**, (see, e.g., column 6, line 19 to column 9, line 3); a syngas conversion system (i.e., a "synthesis loop"; in detail in FIG. 3) converting syngas **11** into higher molecular weight hydrocarbon compounds or oxygenates **14** and producing an offgas **15**, (see, for example, column 9, lines 13-46); and a physical separation zone for separating the various components contained in the offgas **15** produced by the syngas conversion system.

i) For the syngas generation system, Banquy '096 fails to disclose the instantly claimed

syngas generation system, in which the heat for endothermic syngas generation is produced by exothermic reaction of the gas comprising methane with the oxidant gas.

Fong et al., however, teaches a syngas generation system (FIG. 1; column 3, line 65 to column 5, line 34) configured to generate syngas comprising CO and hydrogen by reaction of a gas comprising methane (i.e., in stream 1) with steam (i.e., in stream 5) and oxygen (i.e., in stream 2), wherein heat for the endothermic syngas generation (i.e., conducted in the tube side of the steam reforming catalytic reactor) is produced by exothermic reaction of the gas comprising methane with oxygen (i.e., the product stream from the partial oxidation reactor or gasifier is passed to the shell side of the steam reforming catalytic reactor, to provide heat to the tube side reaction; column 4, lines 26-38). Fong et al. specifically teaches that such a system is an improvement over the prior art syngas generation system in U.S. Pat. No. 4,888,130, or Banquy '130 (Fong et al.: column 2, lines 6-53). It is noted that the syngas generation system in Banquy '130 (see figure) is the same as the syngas generation system in Banquy '096 (see FIG. 2).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to substitute the syngas generation system of Fong et al. for the syngas generation system of Banquy '096, because the syngas generation system of Fong et al. is able to produce stoichiometric ratioed synthesis gas at elevated pressures, while minimizing or eliminating the need for external compression (see, e.g., column 2, lines 45-53; column 3, lines 7-20 and 40-52).

ii) For the physical separation zone, Banquy '096 (see column 9, lines 55-68) discloses that “[a]ny physical separation process can be used” and, in particular, “[t]he physical separation can... be achieved by cryogenic techniques, or distillation at low temperature, such as outlined in *Chemical Engineering Progress*, February 1980, pages 72-79 ...” to Davis et al.

Looking at the cited publication, Davis et al., teaches a physical separation zone (see Figure 2, showing the “methane wash approach”) that separates a feed gas into a hydrogen product, a CO product, and a fuel; wherein the separation zone comprises: a cryogenic separation system (i.e., a methane wash column) that produces the hydrogen product (i.e., in the overhead) and a first cryogenic liquid stream comprising carbon monoxide (i.e., in the bottoms); and a cryogenic distillation column (i.e., CO/CH₄ fractionator) for separating carbon monoxide from the first cryogenic liquid stream to produce the CO product (i.e., in the overhead) and substantially carbon monoxide-free cryogenic liquid (i.e., in the bottoms), usable as fuel; (see also page 74, beginning of column 2, to page 75, end of column 1).

The collective teaching of Banquy '096 and Davis et al., however, is silent as to the physical separation zone having the instantly claimed configuration of a first liquid methane wash column, a second liquid methane wash column, a nitrogen rejection column, and a cryogenic distillation column.

McNeil et al. teaches a physical separation zone (see Figure 1; generally, column 4, line 7 to column 7, line 67) that, similarly to Davis et al., separates a feed gas 1 into a hydrogen product 54, a CO product 44, and a fuel 53; wherein the separation zone comprises:

a first liquid methane wash column (i.e., column 8, supplied with liquid methane from line 36 and pump 38) configured to separate hydrogen from the feed gas 1 to produce a separated hydrogen product that is substantially free of carbon monoxide (i.e., leaving as overhead, via line 12 to the hydrogen rich product line 54) and a first cryogenic liquid comprising carbon monoxide and residual hydrogen (i.e., leaving as bottoms, via line 13), (see column 5, line 56 to column 6, line 2; column 6, lines 54-56);

a second liquid methane wash column (i.e., column **15**, supplied with liquid methane from line **14**) configured to separate the residual hydrogen from the first cryogenic liquid (i.e., fed by line **13**) to produce separated hydrogen usable as a fuel by-product (i.e., leaving as overhead, via line **19** to the fuel gas product line **53**) and a second cryogenic liquid comprising carbon monoxide (i.e., leaving as bottoms, via line **18**), (see column 6, lines 7-24; column 7, lines 21-67);

a nitrogen rejection column (i.e., nitrogen-separation fractionation column **22**) configured to separate nitrogen (i.e., leaving as overhead, in line **25**) from said second cryogenic liquid (i.e., fed by line **18**) to produce a third cryogenic liquid (i.e., leaving as bottoms, in line **26**), (see column 6, lines 25-37); and

a cryogenic distillation column (i.e., a methane-separation fractionation column **32**) configured to separate carbon monoxide from said third cryogenic liquid (i.e., fed by line **26**) to produce separated carbon monoxide product (i.e., leaving as overhead, in line **35** to the CO product line **44**) and a substantially carbon monoxide-free cryogenic liquid (i.e., leaving as bottoms, in line **36**), (see column 6, lines 38-53).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to select the physical separation zone as taught by McNeil et al. for the physical separation zone in the modified apparatus of Banquy '096, because any physical separation process can be used, and a physical separation process employing cryogenic techniques or distillation at low temperature is specifically suggested as being suitable (see Banquy '096: column 9, lines 55-65). Like the cited publication to Davis et al., the physical separation zone of McNeil et al. separates a feed gas into a hydrogen product, a CO product, and a fuel. However,

one having ordinary skill in the art would have been motivated to provide the physical separation zone of McNeil et al. in the apparatus of Banquy '096 because, unlike conventional cryogenic techniques (such as Davis et al.), the separation zone of McNeil et al. further removes nitrogen contaminant from the carbon monoxide product, which would be desirable for environmental and processing reasons (see McNeil et al.: column 1, lines 16-35).

With respect to the newly added limitation of “a conduit for feeding separated carbon-monoxide product from said cryogenic distillation column to said syngas conversion system to remove Argon in a region above a bottom of the cryogen distillation column,” it is noted that the cryogenic distillation column **32** of McNeil et al. (see FIG. 1) has a conduit **35** for discharging separated carbon monoxide product **44**, said conduit **35** being located in a region (i.e., the top region) above a bottom of the cryogenic distillation column **32**. This conduit would also be capable of removing at least a portion of the argon of the process (see Banquy '096: column 9, lines 46-54) from the column, because as is well known in the art of separation, the concentration of argon in the overhead product stream relative to the bottom product stream is a function of the operating parameters (e.g., temperature, pressure) of the column, and in reality, trace amounts of argon would still be present in the overhead product stream.

Furthermore, CO is a considered a reactant in the syngas conversion system, i.e., in the synthesis of hydrocarbons or oxygenates (see Banquy '096: column 1, lines 10-18, 20-33). Accordingly, it would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the conduit to feed the carbon monoxide product from the cryogenic distillation column to the syngas conversion system in the modified apparatus of Banquy '096, because one having ordinary skill in the art would have recognized the carbon

monoxide product to be a readily available source of reactant for the syngas conversion system. Also, the recycling of un-reacted reactants or products for further processing, which advantageously reduces material costs and environmental impact, would have been considered well known to those having ordinary skill in the engineering art.

Regarding claim 24, as noted above, the modified apparatus of Banquy '096 produces a liquid methane product via physical separation (see McNeil et al.: e.g., liquid methane in line 36, discharged via conduit 53; FIG. 1). Furthermore, Fong et al. teaches that the syngas generation system (see FIG. 1; column 3, line 65 to column 4, line 5) consumes methane, e.g., as a feedstock for reforming, or as a fuel for the fired heater. Accordingly, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide conduit means for feeding the methane product to the syngas generation system in the modified apparatus of Banquy '096, i.e., as a feedstock for reforming or a fuel for the fired heater, because one having ordinary skill in the art would have recognized the methane product to be a readily available source of reactant or fuel for the syngas generation system. Also, the recycling of un-reacted reactants or products for further processing, which advantageously reduces material costs and environmental impact, would have been considered well known to those having ordinary skill in the engineering art.

Regarding claim 27, Banquy '096 (see column 9, lines 47-54, with emphasis added) further discloses,

“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen,

and which can be used as fuel in the primary steam reformer.”

As seen in FIGs. 1, 4 and 5, the apparatus further comprises conduit means **12** for removing a portion of the separated hydrogen product, in order to recycle the hydrogen to the syngas conversion system (i.e., the synthesis loop) for generation of higher molecular weight hydrocarbon compounds or oxygenates **14**. Please note that the recitation of a particular molar concentration of helium within the separated hydrogen product stream is considered a process limitation that adds no further patentable weight to the apparatus claim.

Regarding claim 28, Fong et al. teaches a partial oxidation reactor for conducting the reaction of methane with the oxidant gas (see column 4, lines 6-25), and an enhanced heat transfer reformer for conducting the reaction of methane with the steam (see column 4, lines 25-56; also, column 5, lines 23-51).

Regarding claim 29, Banquy '096 discloses that the syngas conversion system comprises at least one FT reactor (i.e., a synthesis converter **SC**, for reacting hydrogen with carbon monoxide, carbon dioxide or mixtures of these carbon oxides to yield organic compounds, such as a hydrocarbon, a mixture of hydrocarbons, an oxygenated compound, or any mixture thereof (see FIG. 3; see column 9, lines 4-46; also, column 1, lines 10-17, lines 20-34).

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy '096 (US 4,782,096) in view of Fong et al. (US 5,496,859), Banquy '130 (US 4,888,130), Davis et al. (“Cryogenics for Syngas Processing”, *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Ireland et al. (US 4,044,063).

The collective teaching of Banquy '096, Fong et al., Banquy '130, Davis et al. and

McNeil et al. is silent as to the apparatus further comprising a hydrogenation system.

Ireland et al. (FIG. 1; see, for example, column 8, line 15 to column 9, line 3) teaches a hydrogenation system (e.g., hydrotreating unit 56; or hydrodewaxing unit 62) for hydrogenating a fraction of the higher molecular weight hydrocarbon compounds 54, 60 produced by a syngas conversion system (i.e., in F-T synthesis zone 4).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a hydrogenation system to the modified apparatus of Banquy '096, on the basis of suitability for the intended use thereof, because the provision of a hydrogenation system helps maximize the production of further liquid hydrocarbon products from the Fischer-Tropsch reaction products stream, as taught by Ireland et al.

8. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy '096 (US 4,782,096) in view of Fong et al. (US 5,496,859), Banquy '130 (US 4,888,130), Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Keller (US 4,650,814).

Banquy '096 discloses that "[a]ny physical separation process can be used" in the physical separation zone and, in particular, "[a]nother physical separation for this purpose is the membrane separation process, which is described in Hydrocarbon Processing May 1980 pages 115-118, and July 1980 pages 65-67," (column 9, lines 55-68).

The collective teaching of Banquy '096, Fong et al., Banquy '130, Davis et al. and McNeil et al., however, is silent as to the provision of a membrane separation system, for removing helium from the separated hydrogen product.

Keller (FIG. 3) teaches a membrane separation system **325** for removing inert gases **344** such as helium (see column 7, lines 6-17) from a separated hydrogen product stream **330**. (see column 13, line 10 to column 14, line 34; see column 15, lines 10-36; see also FIG. 1, column 8, line 14 to column 9, line 8).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a membrane separation system in the modified apparatus of Banquy '096, on the basis of suitability for the intended use thereof, because the membrane separation system enables the generation of a high purity hydrogen stream for use as a recycle, while minimizing the amount of inert compound build-up in the system by separating and removing any inert gases, such as helium, from the system, as taught by Keller.

Response to Arguments

9. Applicant's arguments filed November 23, 2009 have been fully considered but they are not persuasive. Applicant (at the paragraph bridging pages 9 and 10) argues,

“Amended independent claim 19 recites, “a conduit for feeding separated-carbon monoxide product from said cryogenic distillation column to said syngas conversion system to remove Argon in a region above a bottom of the cryogenic distillation column.” In contrast, the cited combination merely teaches that Argon mixed with methane is removed from the bottom of the methane separation fraction column. For example, *McNeil* discloses the stream 32 at the bottom of the methane separation fraction column to remove Argon mixed with methane. Col. 5, lines 10-13. If the methane is recycled to the syngas generation system, then Argon can build up in the system to an unacceptable level. The conduit can, in some implementations, substantially remove Argon from a region above the bottom of the column as a separate stream to prevent unacceptable levels of Argon in the syngas system. Accordingly, Applicant respectfully request reconsideration and allowance of independent claim 19 and its respective dependents.”

The Examiner respectfully disagrees.

As commented above, the limitation of, “a conduit for feeding separated carbon-monoxide product from said cryogenic distillation column to said syngas conversion system to remove Argon in a region above a bottom of the cryogen distillation column,” suggests a cryogenic distillation column having a single conduit for performing the function of feeding separated carbon monoxide and the function of removing argon.

It is noted that the cryogenic distillation column 32 of McNeil et al. (see FIG. 1) has a conduit 35 for discharging separated carbon monoxide product 44, said conduit 35 being located in a region (i.e., the top region) above a bottom of the cryogenic distillation column 32. This conduit would also be capable of removing at least a portion of the argon of the process from the column, because as is well known in the art of separation, the concentration of argon in the overhead product stream relative to the bottom product stream is a function of the operating parameters (e.g., temperature, pressure) of the column, and in reality, trace amounts of argon would still be present in the overhead product stream. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.

Furthermore, CO is a considered a reactant in the syngas conversion system, i.e., in the synthesis of hydrocarbons or oxygenates (see Banquy '096: column 1, lines 10-18, 20-33). Accordingly, it would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the conduit to feed the carbon monoxide product from the cryogenic distillation column to the syngas conversion system in the modified apparatus of

Banquy '096, because one having ordinary skill in the art would have recognized the carbon monoxide product to be a readily available source of reactant for the syngas conversion system. Also, the recycling of un-reacted reactants or products for further processing, which advantageously reduces material costs and environmental impact, would have been considered well known to those having ordinary skill in the engineering art.

Allowable Subject Matter

10. The following amendments to claim 19 drafted by the Examiner and considered to distinguish patentably over the art of record in this application, are presented to Applicant for consideration:

19. (Currently Amended) An apparatus for the production of higher molecular weight hydrocarbon compounds or oxygenates from a gas comprising methane, said apparatus comprising:

a syngas generation system configured to generate syngas comprising carbon monoxide and hydrogen by reaction of the gas comprising methane with steam and an oxidant gas comprising oxygen, wherein heat for endothermic syngas generation is produced by exothermic reaction of the gas comprising methane with the oxidant gas;

a syngas conversion system configured to convert syngas into higher molecular weight hydrocarbon compounds or oxygenates and producing offgas comprising unreacted hydrogen and unreacted carbon monoxide;

a cryogen separation system configured to separate unreacted hydrogen from said offgas or a gas derived therefrom to produce separated hydrogen product that is substantially free of unreacted carbon monoxide and a first cryogenic liquid comprising unreacted carbon monoxide and unreacted hydrogen, the cryogen separation system being a first liquid methane wash column;

a second liquid methane wash column configured to separate unreacted hydrogen

from said first cryogenic liquid or a cryogenic liquid derived therefrom to produce separated hydrogen fuel by-product and a second cryogenic liquid comprising unreacted carbon monoxide;

a nitrogen rejection column configured to separate nitrogen from said second cryogenic liquid to produce a third cryogenic liquid;

a cryogenic distillation column configured to separate unreacted carbon monoxide from said third cryogenic liquid to produce separated carbon monoxide product and substantially carbon monoxide-free cryogenic liquid; [[and]]

a conduit for feeding separated carbon~~[[-]]~~ monoxide product from said cryogenic distillation column to said syngas conversion system ~~to remove Argon in a region above a bottom of the cryogen distillation column; and~~

a conduit located above a bottom of the cryogenic distillation column for removing an argon-enriched sidestream from the cryogenic distillation column.

The proposed amendment to claim 19 overcomes the rejection under 35 U.S.C. 112, first paragraph, and is deemed allowable over the prior art of record. In particular, the cryogenic distillation column 32 of McNeil et al. (see FIG. 1) does not comprise an additional conduit, located above a bottom of the cryogenic distillation column, for removing an argon-enriched sidestream from the column. McNeil et al. specifically states that, "[w]hen the gaseous mixture comprises argon, it can be separated from carbon monoxide in the methane-separation column and removed therefrom with the methane bottoms liquid," (column 5, lines 10-13). Also, "[i]f the gaseous mixture also contains argon, argon content can be removed with the methane content to obviate a separate argon-separation state as required by the prior art processes, " (abstract). The prior art fails to disclose or adequately suggest the claimed apparatus comprising a syngas generation system, a syngas conversion system, a first liquid methane wash column, a second

liquid methane wash column, a nitrogen rejection column and, in particular, a cryogenic distillation column provided with a conduit for feeding separated carbon monoxide product from the column to the syngas conversion system and a conduit located above a bottom of the column for removing an argon-enriched sidestream from the column.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter D. Griffin can be reached on (571) 272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/
Primary Examiner, Art Unit 1797